

What is claimed is:

1. A system for providing patterned illumination fields within an automated visual inspection system, the system comprising:

5 a patterned illuminator configured to provide spatially-adjacent regions of uniform, diffuse lighting and lighting voids to produce engineered illumination fields;

a receiver aperture positioned to receive light generated by the patterned illuminator which has scattered or reflected off a part under inspection; and

10 a transport mechanism used to automatically convey and position parts under inspection within the engineered illumination fields generated by the patterned illuminator.

2. The system as set forth in claim 1 wherein the patterned illuminator comprises a series of annular regions alternating between diffuse, uniform illumination and  
15 lighting voids.

3. The system as set forth in claim 2 wherein the patterned illuminator comprises translucent diffusers having a light blocking annular pattern superimposed on surfaces thereof, said diffusers being backlit by lighting elements.

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4. The system as set forth in claim 2 wherein the patterned illuminator comprises diffuse reflecting surfaces having a light absorbing annular pattern superimposed on surfaces thereof, said diffusers being front lit by lighting elements.

5. The system as set forth in claim 2 wherein the patterned illuminator comprises a series of discrete ring lights of various dimensions positioned to create the alternating pattern of illumination.

5 6. The system as set forth in claim 3 wherein the lighting elements are LEDs.

7. The system as set forth in claim 6 wherein the LEDs are operated in a pulsed-mode to support stop action imaging of the objects under inspection.

10 8. The system as set forth in claim 4 wherein the lighting elements are LEDs.

9. The system as set forth in claim 8 wherein the LEDs are operated in a pulsed-mode to support stop action imaging of the objects under inspection.

15 10. The system as set forth in claim 5 wherein the ring lights are constructed out of LEDs.

11. The system as set forth in claim 10 wherein the LEDs are operated in a pulsed mode to support stop action imaging of the objects under inspection.

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12. The system as set forth in claim 1 wherein the receiver aperture contains a camera capable of generating a two-dimensional image in electronic format of the object under test as it appears illuminated using the patterned illuminator.

13. The system as set forth in claim 12 wherein the receiver aperture additionally contains a processor means to autonomously process the electronic image information into a status summary report indicative of the quality or status of the part under inspection.

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14. A method of illuminating a part under inspection within an automated visual inspection system, the method comprising steps of:

positioning a part under inspection at a selected location relative to a patterned illuminator wherein illumination fields of the illuminator are selectively activated in  
10 an alternating on/off manner to produce an engineered illumination pattern;

illuminating the part under inspection using the engineered illumination pattern produced by the patterned illuminator; and

analyzing light generated by the patterned illuminator that has subsequently reflected or scattered off the part under inspection for the purpose of deducing quality  
15 status information related to the part.

15. The method as set forth in claim 14 comprising additional steps of:

positioning the part under inspection at a second location wherein the illumination fields of a second illuminator are selectively activated in an alternating  
20 on/off manner to produce an engineered illumination pattern such that an inverse engineered illumination pattern is enacted upon the surfaces of the part;

illuminating the part under inspection using the inverse engineered illumination pattern produced by the second illuminator; and

analyzing the light generated by the second illuminator that has subsequently reflected or scattered off the part under inspection for the purpose of deducing quality status information related to the part.